NZPQA

New Zealand Pretend Qualifications Authority

Level 1 Science

AS 1.1 Mechanics - AS 1.5 Acids and Bases - AS 1.9 Genetic Variation

Credits: Not this time

$$V = \frac{\Delta d}{\Delta t} \qquad a = \frac{\Delta V}{\Delta t} \qquad P = \frac{F}{A}$$

$$W = F\,d \qquad F_{net} = m\,a \qquad E_K = \tfrac{1}{2}mv^2$$

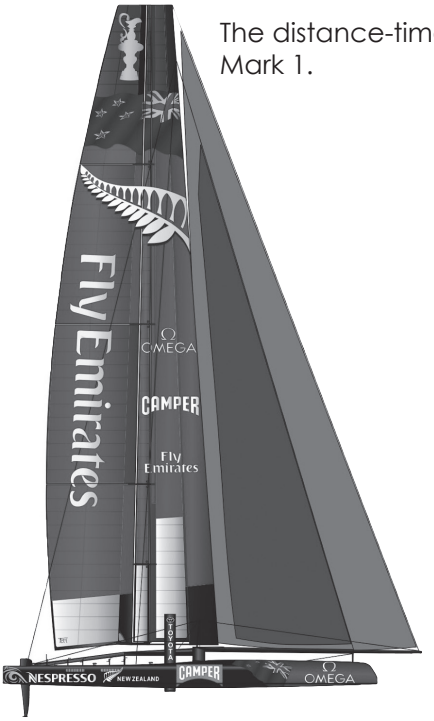
$$g = 10\ N\ kg^{-1} \qquad P = \frac{W}{t} \qquad \Delta E_P = mg\Delta h$$

1+	2+	3+	3–	2–	1–
NH_4^+	Ca^{2+}	Al^{3+}		O^{2-}	OH^-
Na^+	Mg^{2+}	Fe^{3+}		S^{2-}	Cl^-
K^+	Cu^{2+}			CO_3^{2-}	NO_3^-
Ag^+	Pb^{2+}			SO_4^{2-}	HCO_3^-
H^+	Fe^{2+}				
Li^+	Ba^{2+}				
	Zn^{2+}				

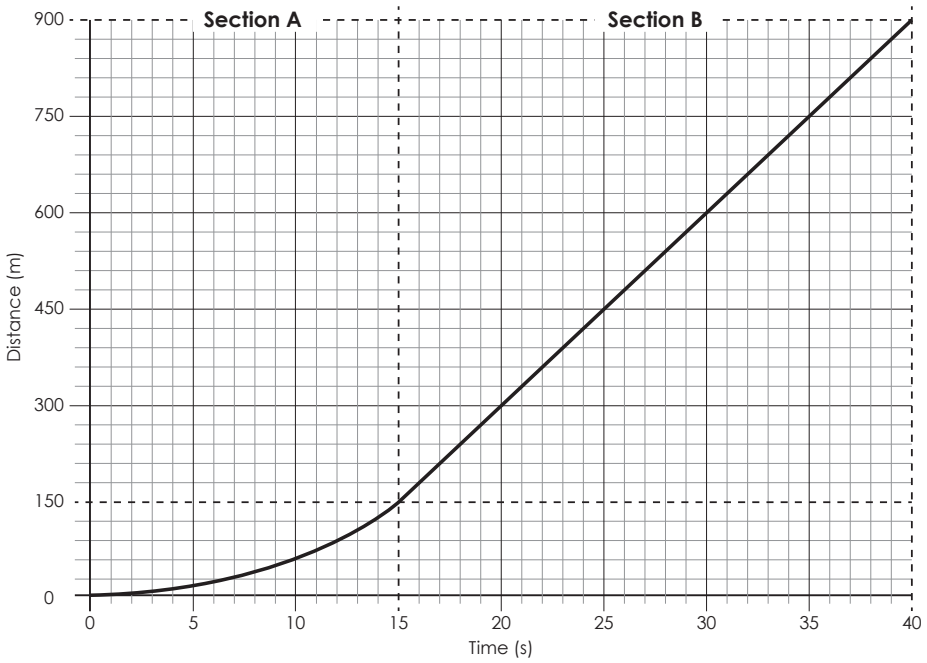
	1																18
1	1 H	2											13	14	15	16	17	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe

For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Demonstrate understanding of aspects of NCEA Level 1 Science ☐	Demonstrate in-depth understanding of NCEA Level 1 Science ☐	Demonstrate comprehensive understanding of NCEA Level 1 Science ☐
Overall Level of Performance ☐		

QUESTION ONE - Americas Cup



The distance-time graph below shows Team New Zealand's progress from the start line to Mark 1.



(a) Use the information from the graph to calculate the average **speed** of the yacht during the first 40 seconds.

Average speed = _____ m s^{-1}

(b) Describe the **motion** of the boat in section B, and explain what this tells us about the **forces** acting on the yacht during this time.

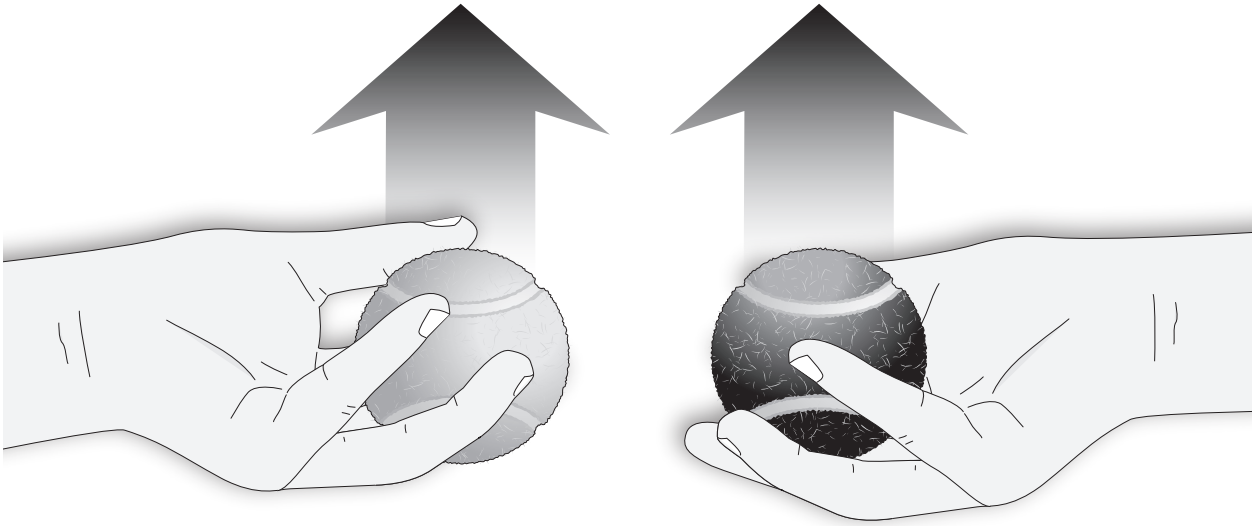
(c) The total mass of the yacht and crew is 6 500 kg.

Calculate the **speed** of the yacht at the end of **section A**, and then calculate the **net force** acting on the yacht during section A of the graph.

Net force = _____ N

QUESTION TWO - Throwing Balls

Two balls of the same *size* and *shape* but with different masses are thrown from the same level vertically upwards. Ball 1 has a mass of 0.05 kg and Ball 2 has a mass of 0.08 kg.



Ball 1 mass = 0.05 kg **Ball 2 mass = 0.08 kg**

1. Both balls reach their maximum heights and have the same amount of *gravitational potential energy*. Comment on the relative **maximum heights** reached by each ball.

2. Compare the relative initial **velocity** of the two balls.

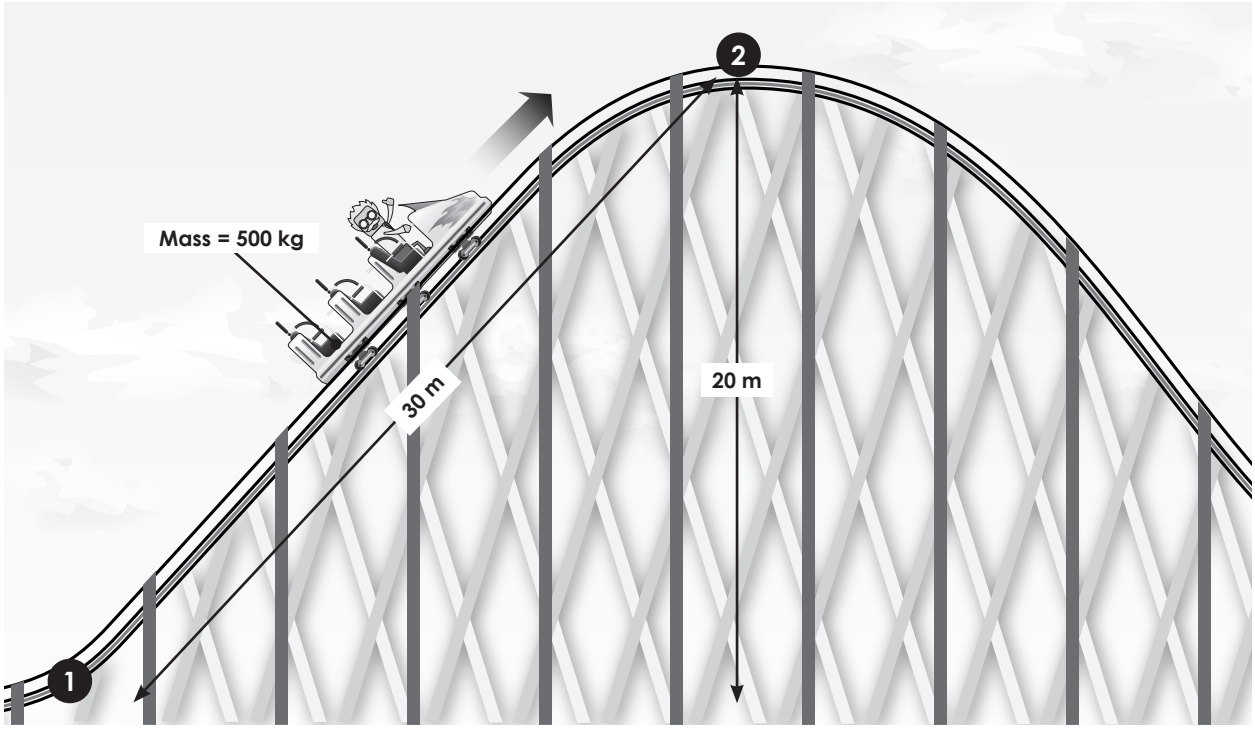
3. Both balls reach their maximum heights, and have 0.4 J of gravitational potential energy.

   (a) Assuming there is no losses, calculate the starting **velocity** of Ball 1 (mass = 0.05 kg).

   (b) In reality the ball's total energy the moment it leaves the throwers hand and at its maximum height will not be the same. Explain how and why the ball's **total energy** changes.

QUESTION THREE - The Roller Coaster

A roller coaster car (mass = 500 kg) is pulled up from position ❶ to the first peak (position ❷) on a roller coaster ride by a motor. The motor pulls the car with a force of 4 000 N.



1. Calculate the **work** done by the motor pulling the car from position ❶ to the top of the first peak (position ❷).

Work done: _____ J

2. Calculate the amount of **gravitational potential energy** the car has at position ❷.

Gravitational potential energy: _____ _____

3. Explain why the gravitational potential energy gained by the car at the top of the peak (position ❷) is **not equal** to the amount of work done by the motor to pull the car up there.

QUESTION FOUR - Mutant Chickens

A mutation occurs in a chicken resulting in a new DNA sequence.

(a) Discuss how the mutation could produce a new **allele**. _____

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(b) The table below shows the original DNA strand and the mutated DNA strand

DNA Strand **before** mutation	DNA Strand **after** mutation
GCTCTAGCCTAGACGATGCCC	GCTCTAGGCTAGACGATGCCC

(i) Circle the mutation.

(ii) Explain why this is a **mutation**. _____

_____

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As a result of this mutation the chicken produces eggs with thicker shells. The shells are not thick enough to prevent the chicks from hatching. However, it results in fewer eggs (and therefore offspring) being lost due to accidental crushing when the hen sits on her eggs or moves around the nest.

(c) Describe the conditions in which this mutation will be inherited by future generations.

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(d) Assuming the mutation is able to be inherited, discuss whether you would expect the mutated allele to increase in frequency within future generations of chickens.

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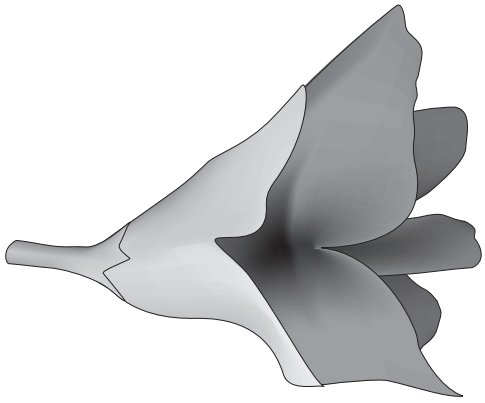
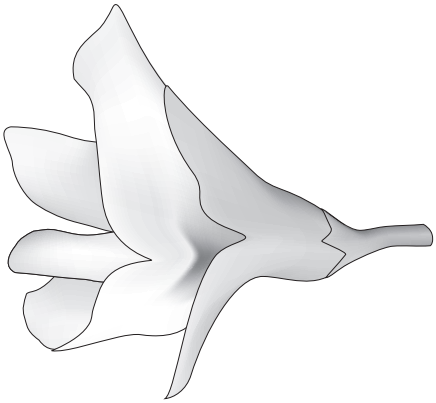
QUESTION FIVE - Mendel's Peas

In pea plants, flower colour is controlled by a single gene. Purple flowering plants are controlled by the allele (F) which is dominant to the white flower allele (f).



Purple Pea Flower

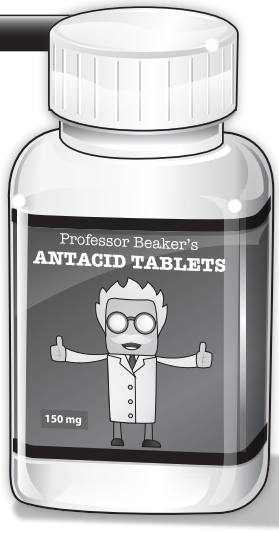


White Pea Flower

A plant breeder suspects that one of his purple flowering pea plants is **pure-breeding**.

Explain how the plant breeder could determine the **genotype** of the purple flowering plant using simple crossing techniques. You should complete at least one Punnett square as part of your answer.

QUESTION SIX - Stomach Acid



Indigestion can be caused by increased concentrations of stomach acid (hydrochloric acid) that rises up into the oesophagus. The stomach is protected from acid as it produces a mucus to prevent the acid from coming into contact with stomach tissue. However, the oesophagus does not produce any protective mucus so the acid can affect the lining of the oesophagus. The pain from indigestion can be treated quickly by using an indigestion (antacid) tablet. An antacid tablet usually contains magnesium hydroxide and calcium carbonate.

(a) Describe what will happen to the **pH** value of the stomach contents when the **concentration** of acid in the stomach is increased.

(b) Discuss why the reaction between magnesium hydroxide and stomach acid (hydrochloric acid, HCl) can be called a **neutralisation reaction**. You should include a word AND a balanced symbol equation in your answer.

Word equation

Symbol equation

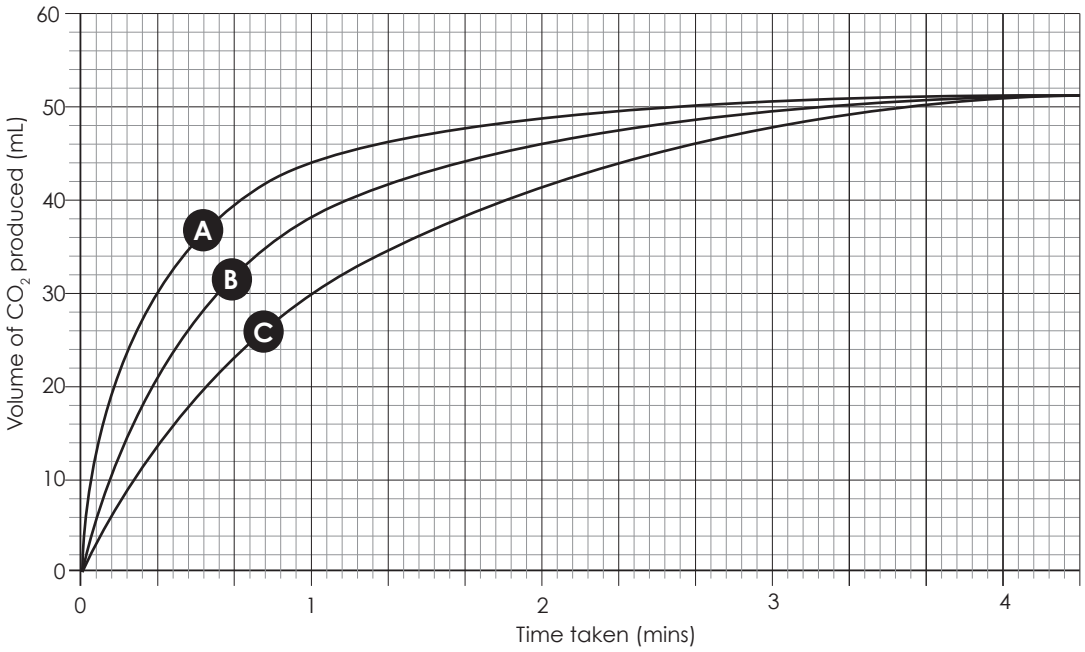
During an investigation into neutralisation reactions student filled a beaker with hydrochloric acid and 5 drops of Universal indicator. They then added sodium hydroxide to the beaker until no more changes were observed.

(c) Describe the **colour changes** as sodium hydroxide solution is added to the beaker, AND explain what this tells you about the changing **pH** of the solution.

QUESTION SEVEN - Carbonate Chips

Potassium carbonate reacts with dilute hydrochloric acid. The rate at which this reaction takes place can be studied by measuring the amount of carbon dioxide gas produced. The graphs below show the results of three experiments A, B and C. In each experiment the amount of calcium carbonate, the volume of acid and the concentration of the acid were kept the same. The temperature of the acid was changed each time. The potassium carbonate was in the form of small, 4 mm chips.

Volume of CO_2 produced when K_2CO_3 reacts with hydrochloric acid at three different temperatures



State which line on the graph represents the reaction at the **highest temperature** AND explain how you determined this. In your answer you should:

- Identify which line represents the reaction at the highest temperature.
- Explain why the line you have identified is the reaction at the highest temperature.
- Give reasons for the different rates of reaction in terms of particles.
- Explain why all lines end up horizontal.